ATTACHMENT

Technical Comments on

Comments Regarding FCC 06-164 in the matter of the Effects of Communication Towers on Migratory Birds, WT Docket No. 03-187, by Joelle L. Gehring, Ph.D., Michigan State University

Biological Significance of Avian Mortality at Communication Towers and Policy Options for Mitigation: Response to Federal Communications Commission Notice of Proposed Rulemaking Regarding Migratory Bird Collisions with Communications Towers, WT Docket 03-187, Land Protection Partners

Comments of the U.S. Fish and Wildlife Service, WT Docket 03-187, FCC 06-164, Notice of Proposed Rulemaking, Effects of Communication Towers on Migratory Birds, February 2, 2007, Letter to L. Peraetz, Federal Communications Commission, from K. Stansell, Acting Deputy Director, USDI Fish and Wildlife Service, Washington

Response of Night-migrating Birds in Cloud to Colored and Flashing Light; Report to the Communications Tower Working Group by W.R. Evans, *et al.*

Prepared for

CTIA – The Wireless Association
National Association of Broadcasters
National Association of Tower Erectors
PCIA – The Wireless Infrastructure Association

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1.0 General Comments

On August 20, 2003, the Federal Communications Commission (FCC) issued a Notice of Inquiry (NOI) to gather comments and information on the impact that communication towers may have on migratory birds. In response to the NOI, a review of the published literature was conducted by Woodlot Alternatives, Inc. (Woodlot) to determine what was known, and was not known, about the effects of communication towers on avian mortality, and to determine how significant the mortality may be to bird populations. A report was submitted to the FCC in November 2003 with the findings of the review. The most important conclusion reached after reviewing the then-current literature on avian mortality at communications towers was that there was a need for further research, and no estimate of mortality could be considered very accurate without it. The occurrence of some avian mortality at communication towers was well documented, but the effect of this mortality on migratory bird populations was (and still is) unknown. One particular area of uncertainty is the correlation between avian passage rates during migration (i.e., how many birds are moving through an area) and the incidence of collision. Without knowing this, improper correlations can be drawn, possibly leading to improper tower design guidelines.

In February 2005, Woodlot submitted technical comments on the report by Avatar Environmental, LLC and concluded that there was no evidence in the record indicating that communications towers were having a biologically significant impact on migratory bird populations. Later, in June of that year, Woodlot also reviewed and commented on a Land Protection Partners (LPP) report.[1] The statistical analyses used in that report were flawed and did not provide an accurate representation of nationwide avian mortality related to communications towers. The findings from that report should not be used to estimate risk to bird populations. Following the review of the report, Woodlot recommended that scientifically valid research work be conducted and properly reported before specific design recommendations are incorporated into federal policy on the build-out and deployment of our nation's communications infrastructure, specifically broadcast and wireless towers.

Since that time, the FCC released a Notice of Proposed Rulemaking (NPRM) on November 7, 2006, to gather additional comments, and there have been several studies that have added to the body of knowledge regarding migratory birds, communication towers, and lighting. While the body of knowledge has advanced, there is still insufficient evidence and/or the record is too much in conflict to warrant any action regarding uniform tower design guidelines or to support a finding of biological significance. As discussed below, on-going recent work investigating the effects of different lighting on birds is still contradictory. For example, the lighting guidelines recommended by the United States Fish and Wildlife Service (USFWS) are not supported by the findings from another study by Evans *et. al.* (2007),[2] which the USFWS partly sponsored. One commonality of the researchers' conclusions is the need for additional study. Specific comments are provided below.

- The first report discussed below is known as the Michigan study. This multi-year study investigated the relationships between tower height, tower lighting, guy wires, and rates of avian

[1] *Scientific Basis to Establish Policy Regulating Communications Towers to Protect Migratory Birds: Response to Avatar Environmental, LLC, Report Regarding Migratory Bird Collisions with Communications Towers, WT Docket No. 03-187, Federal Communications Commission Notice of Inquiry,* filed on February 14, 2005.

[2] Evans, W.R., Y. Akashi, N.S. Altman, and A.M. Manville II. 2007. Response of night-migrating birds in cloud to colored and flashing light. A report to the Communications Tower Working Group by (lead author) Old Bird, Inc., 605 W. State Street, Ithaca, NY.

mortality. It is one of the best studies of its kind to date, and provides more information to the body of knowledge regarding communication towers and avian collisions. However, design limitations, funding, and study findings that contradict other recently completed work indicate that the Michigan study cannot provide all the answers for which the researchers and the FCC were looking. The study was unable to correlate bird migration rates with the incidence of collision, so it is uncertain the extent to which tower design or/or siting contributed to avian mortality, or if all towers in the study had the same rates of collision but varying passage rates. One finding of interest was that the overall incidence of mortality was low.

- The second report discussed is the latest LPP report (April 2007). The comments in this report are not transparent because they do not contain the information necessary to corroborate their analysis. The LPP report has also not completed peer review. While there are multiple analyses presented that all build on one another, the fundamental underpinning of the analyses, the regression equation, cannot be independently verified. If the equation is incorrect, biased, or highly uncertain, which we believe is entirely possible because of stochasticity and incomplete knowledge, their entire analysis is flawed and their data are not credible.

- The third report discussed is the comments submitted by the USFWS. The USFWS comments largely repeat existing data that have already been reviewed and commented on in earlier reports prepared by Woodlot. They also describe new findings from the Michigan study and work preformed by Evans, Akashi, Altman and Manville, which is also described below. The USFWS comments point out that some findings from the Evans *et al.* (2007) report contradict those of other studies, and that additional research is needed on lighting.

- The fourth report discussed is the *Response of Night-migrating Birds in Cloud to Colored and Flashing Light; Report to the Communications Tower Working Group* by W.R. Evans, Y. Akashi, N.S. Altman, and A.M. Manville. This study indicates that flashing versus non-flashing light may have more of an influence on attracting birds than the color of the light. The study also found, however, that red versus red strobe versus white strobe are all no different than darkness as an attractant. This is a significant observation because it calls into question whether any one lighting preference will make a difference. Because of this and other findings, more study is needed before policy decisions can be made regarding light color or light flashing frequency.

As discussed in more detail below, there is a little more known now than three years ago about the effects of communication towers and avian mortality, but not much more. Based on the findings of the Michigan study and the study performed by Evans *et al.*(2007), contradictions in findings point out the need for more research so that any recommended tower design changes are not later found to be wrong.

2.0 Comments Regarding FCC 06-164 in the matter of the Effects of Communication Towers on Migratory Birds, WT Docket No. 03-187, by Joelle L. Gehring, Ph.D., Michigan State University

The following information includes observations and comments on studies conducted primarily by Joelle L. Gehring, Ph.D., regarding the effects of communication towers on migratory birds, as well as observations regarding Dr. Gehring's comments concerning FCC 06-164 (WT Docket 03-187), which are

based on the aforementioned studies.[3] This cautionary critique, submitted with all due respect for the researchers, is important in that some commentators are citing Dr. Gehring's work as definitive proof that tall towers, towers with guy wires, and towers with certain lighting parameters have disproportionately higher fatality rates for migratory birds on a national level. While this study specifically addressed important information needs, it was but one study, and was limited by funding, access to sites, inability to quantify bird passage rates in relation to impacts, and sample size. All of these factors hamper our ability to draw conclusive inferences without supplementary research work. Additionally, there were relatively small rates of avian mortality during the course of the investigation.

2.1 LACK OF PEER REVIEW OF STUDY RESULTS AND LACK OF TRANSPARENCY IN DATA ANALYSIS

- The study results are presented as definitive, whereas Dr. Gehring states that, "This study will be submitted to appropriate scientific journals for additional peer review and publication." Such reviews will represent the first true peer review of these studies, and until they are complete and the work is accepted for publication, the results must be considered preliminary and conclusions drawn from them tentative.

- Dr. Gehring states in her comments that, "The initial research proposal and the final reports have been reviewed by several scientists and statisticians." The results of these reviews, whether positive or negative, however, are not presented. In addition, the initial study plan acknowledges that, "…implementation of this pilot study [i.e., studies conducted in 2003, the first year of the study] is necessary to address questions raised by the reviewers about the sample size for the main study and the statistical validity of the results that might be gained there from."[4] It is not clear from the material submitted to the FCC, however, whether these initial reviewer concerns were adequately addressed when implementing the study.

- Requests for the raw data collected as part of this study, which could be used to better understand the statistical robustness and uncertainty and independently corroborate Dr. Gehring's statistical analyses, have been consistently refused. We recommend independent corroboration of Dr. Gehring's analysis of the raw data – or peer review and publication of the results – prior to the data being used as an input for the setting of national policy for communication towers. One of the main reasons for seeing the raw data is that overall rates of mortality were low. We know that there were multiple zeros in the count data (i.e., some towers had no mortality). Without seeing the raw data, it is not possible to see which towers were responsible for avian mortality. We are also unable to see if a particular tower was responsible for most of the observed mortality, or whether observed mortality was equally distributed. One measure of how similar the towers were in each grouping or treatment was whether there were similar rates of observed mortality. If each group of towers was indeed similar, then there should be equal distribution of avian mortality. If the towers in each group were being influenced by some other parameter (e.g., passage rate, landscape position), then that may be a factor that should be accounted for in the analysis.

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[3] Gehring, J.L. and P. Kerlinger. Undated. Avian collisions at communication towers: I. The role of tower height and guy wires and II. The role of Federal Aviation Administration obstruction lighting systems. Reports prepared for the State of Michigan by J.L. Gehring, Michigan Natural Features Inventory, Lansing, MI, and P. Kerlinger, Curry & Kerlinger, Cape May Point, NJ.

[4] Gehring, J.L. 2002. Pilot study for the avian collision study plan: quantifying avian mortality associated with the Michigan Public Safety Communications System.

Ideally, the only parameters differing between towers would be the factors under study (e.g., height, guy wires, and lighting).

2.2 STUDY PLANS WERE NOT FULLY ADHERED TO

- The basic premise of the research is that higher numbers of bird carcasses at a tower relates directly to the characteristics of the tower. Dr. Gehring, for example, hypothesizes that more birds die at taller towers, at towers with guy wires, and at towers with certain lighting arrays. She believes that her data support this conclusion. The number of dead birds observed at an individual tower, however, is also likely a function of the number of birds passing by, the weather at the time of passage, and the location of the tower on the landscape. These factors are addressed in Dr. Gehring's final study plan[5] but are not addressed in the comments or reports submitted to the FCC. We understand that a companion study using marine radar to estimate bird passage rates was not able to be conducted. The findings from that study would have provided an opportunity to correlate bird passage rates with the observed incidence of collision. Thus, an important variable was not tested or measured.

- Dr. Gehring indicates that, "The Michigan study was the first controlled or 'experimental' study to examine the relative risks that tower support systems and tower height pose to migrating and other birds." The study is an "observational" one whereby observers counted birds at certain towers and tried to relate the observations to the physical quality of the tower. As noted above, factors that are just as likely to contribute to the observed data include the number of birds passing by, weather, and location of the tower on the landscape. In addition, none of the variables that are highlighted – tower height, guyed versus un-guyed, and lighting – was effectively "controlled" in this experiment. A true controlled experiment, for example, might consist of several years of monitoring a sample of towers to establish baseline conditions, followed by changing tower conditions (e.g., lowering a tower) and monitoring the tower for additional years. We recognize that there are logistical constraints that limited the Michigan study; these constraints limit the robustness of the study, and caution should be used in applying the study's findings in a universal manner.

- The initial study plan described 2003 studies as a part of a pilot study designed to provide preliminary data to estimate data variance, determine statistical power of the proposed analyses, explore methods of economically increasing the main study's sample size of towers sampled, and field-test research methods. The final reports, however, fail to clearly indicate that the 2003 data are part of such a pilot study. They are, instead, included as a definitive part of the study. We believe that these data should be reported, but as part of a pilot study that includes the power analyses and sample size calculations for future studies originally envisioned by the researchers. If such analyses were conducted, they are not included with the final report.

- The pilot study indicated that researchers would investigate the utility of NEXRAD weather radar as a method of quantifying the numbers of birds flying over towers on the nights previous to searches. This work, if done, is not included in the final reports. As the study plan

[5] Gehring, J.L. 2003. Avian collision study plan for the Michigan Public Safety Communications System (MPSCS): Assessing the role of lighting, height, and guy wires in avian mortality associated with wireless communications and broadcast towers.

acknowledges, observed mortality at individual towers is influenced by the number of birds flying by. To help control what the researchers call "migration intensity," they stated, "To insure that migration intensity is controlled (relatively similar), all towers in the study, with two exceptions, will be in the Lower Peninsula." The final report, however, includes five towers in the Upper Peninsula (out of 19 total), four of which were guyed with red strobe light systems and within the 116 to 146-meter Above Ground Level (AGL) height class.

- Not following the apparent study design to control for migration intensity confounds interpretation of the results. Assume, for example, that short and tall towers impact the same percentage or proportion of birds passing by under a given set of weather parameters. If this is true, then the number of dead birds that are observed would be a function of how many are flying by (i.e., more birds flying by would theoretically result in more dead birds on the ground). In this regard, it may not be prudent to conclude that observing more dead birds on the ground at any particular site is directly due to the characteristics of the tower. It may be primarily related, instead, to the number of birds passing by, which is unknown in this study.

- Study results are further confounded by the location of some of the sample towers. One tower (guyed, red strobe light system, 116 to 146-meter AGL), for example, is directly on Keweenaw Point, which juts into Lake Superior and is a widely known congregation point for birds migrating across Lake Superior. Keweenaw Point is so well known as a bird congregation area that the region hosts an annual International Migratory Bird Day Festival. Due to the number of birds in the area, it is possible, therefore, that this one particular tower is unduly influencing mean values for this class of tower. Absent the raw data, however, this possibility cannot be investigated.

- In addition to the Keweenaw Point tower, the remaining four towers in the Upper Peninsula – three of which are also guyed, red strobe light system, 116 to 146-meter AGL towers – are also in areas specifically known to attract concentrations of migrating birds as they prepare to cross the Great Lakes.

- If one draws a line east to west from approximately lower Saginaw Bay to Ludington on the shore of Lake Michigan, it can be shown that south of this line, there are eight un-guyed towers and only two guyed towers. North of this line, there are only one un-guyed tower and 10 guyed towers (all towers are red strobe light system, 116 to 146-meter AGL towers). It is clear, therefore, that there is a geographical bias in the location of the sites, with the majority of the guyed towers in the northern part of the State, including the Upper Peninsula, and the majority of the un-guyed towers in the southern part of the State. It is conceivable, then, that there are more birds passing by the northerly towers as birds funnel to points where Lake Superior is crossed. Once again, the raw data should be made available so that the potential influence of this apparent bias can be independently evaluated.

- The study plan notes that some sample towers will be located within five miles of the shores of Lake Huron and Lake Michigan in an effort to address concerns that these areas attract more

migrating birds and are, therefore, "riskier" [Gehring's term] to migrating birds.[6] Whether the location of the tower in relation to these lakes influenced observed fatality rates, however, is not reported. Absent the raw data, this possibility cannot be investigated.

- The study plan called for focusing on nights with inclement weather as this has "…been demonstrated to cause large-scale or catastrophic mortality events." If weather variables were measured during the study and if they influenced observed fatality rates, it is not described in the final reports.

2.3 THE EXPERIMENTAL DESIGN IS NOT ROBUST

- In general, the researchers took all the towers available to them in Michigan and treated them as a single sample population. The only stratification variables used when selecting towers were tower height, guyed or un-guyed, and lighting system. Proximity to the shore was also intended to be a stratifying variable, but these results are not reported. Some towers were also excluded if they were too near well-lit areas. It could be argued, however, that these should have been included as representative of certain tower conditions. A more robust experimental design would have been to also stratify based on geographic location for the reasons stated above (i.e., some towers are in areas such as the Keweenaw Peninsula that are known to concentrate birds). In addition, it would have been more robust to pair samples and compare results. For example, just east of Marquette, in the Upper Peninsula, there is a pair of guyed and un-guyed towers (same height and lighting class) that are next to each other. Additional pairs of guyed and un-guyed tower pairs can be found north of Ludington, west of Saginaw Bay, and southwest of Ann Arbor. Given access to the raw data, one could still evaluate these pairings to determine if the stated trends in fatalities for guyed and un-guyed towers held up to a pair-wise analysis that limits the effects of geography.

- A more robust experimental design would have accounted for the potential effects of differing weather conditions at individual towers prior to when surveys were conducted, as the study plan proposed, but does not appear to have been carried out. It is possible, for example, that towers with higher observed fatalities also had inclement weather prior to the survey.

- The authors present two separate reports using essentially the same data set. One analyzes the data in terms of tower height and guying status whereas the complementary report looks at the data in terms of how the towers were illuminated. A more robust experimental design would have been to include all of these parameters in a single unified multivariate analysis (i.e., an analysis that examines how multiple response variables such as tower height, tower lighting, guy wires, landscape position, and bird passage rates are related simultaneously to one or more predictor variables such as avian mortality). It is likely that this was not done, however, because the sample sizes would have been inadequate to support such an analysis. Of note is that the findings on the influence of lights as an attractant to migrating birds from the Evans *et al.* (2007) study, discussed below, are not in agreement with those of the Michigan study.

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[6] The study plan notes, "The inclusion of these towers [within 5 miles of the Great Lakes] were added as a means of specifically answering questions posed by National Wildlife Federation and others about towers in the Upper Peninsula and near lakeshores."

2.4 SAMPLE SIZES ARE SMALL

- Because the sample sizes resulting from this study are relatively small and robust statistical analyses, like a multivariate analysis, could not be performed, they should not be taken as definitive proof of cause and effect (i.e., that guyed towers, tall towers, or towers with certain lighting systems definitely experience higher rates of bird mortality). In 2003, for example, a total of only six towers (116-146 meters AGL) were sampled (3 guyed and 3 un-guyed). This is too small a number (n=3 for each category) for the mean and standard error, as reported in Table 1, to be meaningful. The Michigan study instead should have reported the exact counts of dead birds at each tower. Furthermore, no dead birds were observed at the un-guyed towers, resulting in a Mann-Whitney U value of 0. Under these circumstances, it would be more appropriate, due to the small sample sizes and the lack of any recordable data at the un-guyed towers, to simply present the raw data. It is misleading to conclude that there is a statistically significant difference between guyed and un-guyed towers based on these data.

- Additional towers were included in the 2004 study, particularly for towers in the 116-146 meter AGL category, making the mean values somewhat more reliable. Nonetheless, it is more appropriate, with such small sample sizes, to report all raw data for each tower (see above comments under lack of transparency in data analysis). In 2005, sample sizes were again small and the raw data should have been reported (i.e., the mean and standard error are unreliable with such small sample sizes).

- Based on the results of the Kruskal-Wallis analysis of the spring and fall 2004 data, Gehring reports that the number of birds killed at the three categories of towers (i.e., 116-146 meters AGL [with and without guy wires] and guyed towers greater than 305 meters AGL) is statistically different. Although this may be a reasonable conclusion, it would be useful to know the exact number of birds killed at each tower rather than just the totals and means, as reported in Tables 2 and 3. It is possible, for example, that results at a small number of towers skewed the results of the Kruskal-Wallis test. In addition, with such a small sample of towers greater than 305 meters AGL, one should be cautious in concluding that taller towers result in increased mortality.

2.5 CONCLUSIONS AND RECOMMENDATIONS ARE NOT SUPPORTED BY STUDY RESULTS

- Dr. Gehring states that, “I believe that current research provides realistic options to drastically reduce the numbers of migratory birds colliding with communication towers while minimizing the financial impact to the tower industry.” Such statements, however, are uncertain because of study limitations, as discussed above. If the recommendations on lighting, for example, are wrong, then costly changes in tower design could be mistakenly made that may have no impact on avian mortality or are even unintentionally harmful, and those changes may then later have to be reversed.

2.6 STUDY RESULTS ARE MISAPPLIED WHEN ESTIMATING REDUCTIONS IN MORTALITY

- Dr. Gehring states that, “Our results show that bird fatalities can be reduced by 69% to nearly 100% by constructing un-guyed towers instead of guyed towers, and 68%-86% by constructing towers 116-146 m Above Ground Level (AGL) instead of towers >305 m AGL.” This statement is also uncertain, as discussed above, and it may be a misapplication of the results of the study. If

the differences in observed rates of mortality were due to differing bird passage rates, then her conclusions and recommendations are also incorrect.

3.0 Biological Significance of Avian Mortality at Communication Towers and Policy Options for Mitigation: Response to Federal Communications Commission Notice of Proposed Rulemaking Regarding Migratory Bird Collisions with Communications Towers, WT Docket 03-187, Land Protection Partners

The LPP comments start out by restating early estimates of numbers of avian mortality developed by Banks[7] using three towers, two in Florida and one in South Dakota. As pointed out in our previous comments, extrapolating avian mortality estimates from three towers with known incidences of elevated levels of avian collision is inappropriate and misleading. Those three towers are not representative of all of the towers currently or previously in use. As noted in the Michigan study, some towers were reported to have no avian mortality during the fall and spring of 2003 and 2004, respectively (see Tables 1 and 2 in the Michigan study). The objective of the FCC NOI and NPRM process is to generate and evaluate unbiased data on tower siting and design and to evaluate what is known and unknown about how towers affect migratory birds. If data are not collected and presented in a transparent, unbiased manner, then resulting extrapolations can be misleading and flawed and should not be relied upon to estimate biological significance.

The LPP comments are not transparent, have not completed peer review, and do not provide the detail necessary to corroborate their analyses. There is little new independent data presented. While there are multiple analyses presented, which all build on one another, the fundamental underpinning of the analyses, which is the regression equation, cannot be independently reproduced and verified. If the equation is incorrect or highly uncertain, which we believe is entirely possible because of stochasticity and incomplete knowledge, their entire analysis is flawed. Because of this, and for other reasons described below, their data and conclusions need to be reviewed very cautiously.

3.1 Lack of peer review of study results and lack of transparency in data analysis

- In their comments, LPP state "the material in this report is based on two scientific manuscripts prepared by the authors. One of these manuscripts is in review and the other is in preparation." Neither papers have gone through peer review and are unavailable for our review or use. Until the peer reviews are complete and the work is accepted for publication, the results must be considered too preliminary for conclusions to be drawn.

- The foundation of the LPP comments is based on a regression model used to estimate mortality. The regression was based on a correlation between tower height and average annual mortality. This regression model is not available for review, and has not yet undergone or completed peer review. There is an overall lack of transparency in their comments because of the unavailability of this regression model. The estimates provided in their analysis do not account for uncertainty in their model, which is misleading, and may not properly account for uncertainty.

- The uncertainty in the regression model and each estimated number are not shown in their analysis. Each estimate should be bounded by confidence limits (i.e., a range of values that the

[7] Banks, R.C. 1979. Human related mortality of birds in the United States. U.S. Fish and Wildlife Service, Special Scientific report – Wildlife 215:1-16.

estimate is believed to fall between), or illustrate in some manner the probability that their estimate occurs within a certain range of values. Because this was not done, the numbers appear as points (i.e., one number) when in fact they are approximations based on the regression equation. This inhibits the use of the data and precludes transparency. The authors also admit that their estimates may be flawed because they "may reflect historical rather than current patterns." (section 2.3, page 14)

- Numerous assumptions are made in their analysis. These assumptions (emphasis added below) further compound uncertainty and transparency.
    - "We **assumed** that searchers on average locate half of all birds…" (page 3); this is higher searcher efficiency than has been reported in recent studies (see Gehring's work where rates were 24%, 31%, 27%, 40%, and 48% during 5 study periods between the fall of 2005 and fall of 2003, for example).
    - "We then made the very conservative **assumption** that scavengers reduced counts by 50%." (page 3). This assumption is an example of another assumption that should be accounted for in the numerical analysis, the uncertainty of which grows with each new assumption.
    - "We included only those Bird Conservation Regions where substantial avian mortality has been reported at towers, or can be **presumed** to occur based on geographic proximity to recorded mortality sites" (page 3). This methodology is biased. By choosing areas with known substantial avian mortality, versus towers where there is little or no known avian mortality, the methodology is biased to estimate high mortality. This is important because later on in their comments, they provide their thoughts on biological significance, which is based on this biased high method for estimating potential mortality.
    - "Accounting for searcher efficiency and scavenger removal together leads to the **assumption** that recorded numbers of bird mortalities are at most 25% of the total number of birds killed" (page 3). This is another example of how bias enters into their analysis. Estimated mortality should be bounded by the high- and low-end of the estimate to provide transparency and allow the reader to assess what is and what is not known in an unbiased manner.
    - "This extrapolation **assumes** that all towers were guyed with continuously illuminated red and blinking red lights…" (page 4); towers with these characteristics have been reported by some researchers to have the most elevated levels of avian mortality. By using these towers as the standard, the resulting estimates of avian mortality are likely to be biased high.
    - "We **assumed** that half of all towers would cause avian mortality" (page 4); this assumption is made because two other authors made the assumption. The authors of the LPP should once again assign a level of certainty to this assumption.
    - "…it would be reasonable to **assume** that in the United States far greater than 50% of towers more than 300 m (984 ft) tall cause avian mortality." (page 5). In this section of

the report, the authors cite work conducted in Sweden where there was an observed lack of mortality at some towers. They then state that "Our estimates do not extend to latitudes with diminished numbers of nocturnal migrants…" (page 5). As pointed out in the earlier Woodlot report, there are few studies of tower caused avian mortality in the western United States. Most studies reported to date are from areas where there have been elevated rates of mortality, which potentially biases overall estimates high.

- "…we **assume**, and these data support the assumption, that tower height does not influence the proportions of different species killed at towers." (page 8). In this analysis, which is also not included in the report and therefore cannot be reviewed or verified, the authors use a single tower in Florida to estimate whether there is a difference in species assemblage among birds killed at shorter versus taller towers. The tower height was changed from 204 meters to 308 meters. Both of these tower heights are higher than most in the United States (see Table 1) and are not representative of all towers in the United States. Also, this analysis represents a single sample point, which is the smallest sample size possible.

- When all of these and other assumptions are added up, there is considerable uncertainty in their analysis. Without clearly showing this uncertainty numerically, the reader can be mislead and think that the estimates of mortality are better than they may actually be. The authors of the LPP report should assign probabilities to their estimates to numerically show the associated uncertainty.

- Tables 1, 2, 3 (both of them; i.e., there are two Table 3s) rely on the LPP regression model to estimate potential mortality due to towers. The numbers in these tables are based on the non-peer-reviewed regression equation, which is not available for independent corroboration. The numbers of studies contributing to the regression as indicated in Table 1 show that 95.5 percent of the towers were represented by only 3 of 30 studies used in the regression. This is a significant bias in the analysis, and indicates that the regression model is likely flawed if the three studies are not truly representative of all towers less than 150 meters tall. As described in previous comments,[8] most of the studies used to develop the regression model are based on higher towers, and the vast majority of towers are not properly represented, which can cause considerable bias. The authors do not attempt to describe the bias or account for the associated uncertainty in their analysis; rather, they present single number estimates.

- We are uncertain if the regression they are referring to is one previously presented by LPP in comments they submitted in 2005. If they are, the regression model previously prepared was

[8] Technical Comment on Scientific Basis to Establish Policy Regulating Communications Towers to Protect Migratory Birds: Response to Avatar Environmental, LLC, Report Regarding Migratory Bird Collisions with Communications Towers, WT Docket No. 03-187, Federal Communications Commission's Notice of Inquiry (Longcore, *et al.* 2005) and Reply Comments to Avatar Environmental, LLC, Report Regarding Migratory Bird Collisions With Communication Towers, WT Docket No. 03-187 (Longcore and Rich 2005).

flawed (see comments submitted previously),[9] and does not provide an accurate representation of avian mortality related to communications towers.

- Their comments on biological significance are based on their regression equation, which they used to estimate the average number of birds killed per year. These estimates are uncertain for reasons stated above, and also should be bounded by confidence limits. It is misleading to show a single mean number without the variance, which is a measurement of how much the actual values differ from the expected value. We suspect the variance would be high and estimates bounded by large confidence limits because of the inherent uncertainty in their analysis. LPP agrees with the uncertainty and states "These total mortality estimates must be interpreted with caution" (page 13). Users of this information need to be cautious so that they do not assign more value to the estimates than they should, given the uncertainty surrounding the estimates. LPP's subsequent comments on estimated biological significance must also be viewed with caution because they are based on numerous assumptions and could be misleading.

- LPP's comments on how towers could contribute to population decline in bird species are very speculative and misleading. Their estimates are not bounded, uncertainty is not numerically shown, and the reader is once again left to assume that their regression equation is correct.

- The LPP comments do not present any new information on lighting that is not addressed elsewhere in these comments.

- The LPP comments do not present new information on the importance of guy wires or tower height that is not already addressed elsewhere in these comments.

In conclusion, the LPP comments are not transparent, have not completed peer review, and do not provide the detail necessary to corroborate their analyses. If some of their assumptions are incorrect, their analyses are likely flawed, and little reliance should be placed on their estimates.

[9] Technical Comment on Scientific Basis to Establish Policy Regulating Communications Towers to Protect Migratory Birds: Response to Avatar Environmental, LLC, Report Regarding Migratory Bird Collisions with Communications Towers, WT Docket No. 03-187, Federal Communications Commission's Notice of Inquiry (Longcore, et al. 2005) and Reply Comments to Avatar Environmental, LLC, Report Regarding Migratory Bird Collisions With Communication Towers, WT Docket No. 03-187 (Longcore and Rich 2005).

4.0 Comments of the U.S. Fish and Wildlife Service, WT Docket 03-187, FCC 06-164, Notice of Proposed Rulemaking, Effects of Communication Towers on Migratory Birds, February 2, 2007, Letter to L. Peraetz, Federal Communications Commission, from K. Stansell, Acting Deputy Director, USDI Fish and Wildlife Service, Washington

In large part, the USFWS comments repeat previously submitted testimony and information already placed into the record. Previous reviews and analyses of this information suggested that these data were insufficient to support action.[10]

- The USFWS comments present few new data; the Michigan study performed by Dr. Gehring in conjunction with the USFWS is cited, as is the study by Evans, Akashi, Altman, and Manville,[11] for which the USFWS was also a collaborator. Also cited is a book edited by the primary authors of the LPP comments, entitled *Ecological Consequences of Artificial Night Lighting.* Very little new scientific information is discussed; rather, information previously reported is presented again. The Michigan study is described above. While it is one of the better studies to date, its robustness was limited by sample size and some of the other issues described above. The Evans study, which has been peer-reviewed, has findings regarding different types of lighting and attractiveness to birds, which are not in agreement with those of USFWS. Both studies recommend further research. New information in the USFWS comments includes personal communications from Robertson, Clark, Evans, and Ugoretz (see pages 5-7 in section entitled Summary of Avian Mortality), none of which has undergone peer review.

- Some of the USFWS comments support the idea of further research. The USFWS comments cite Dr. Gehring's work and that conducted by B. Evans (Evans *et al.* 2007) regarding the effects of different types of lighting on bird aggregation. Gehring found that "a blinking light versus a steady-burning light is more important than the color of the blinking light. Evans *et al.* (2007), however, did not find either steady-burning red (L-810) or red flashing (L-864) beacons induced bird aggregation when tested separately at ground level in 100% cloud cover…". The comments continue "more laboratory and field studies will be necessary to better understand aggregation to certain light types as well as the role of magneto-reception."

5.0 Response of Night-migrating Birds in Cloud to Colored and Flashing Light; Report to the Communications Tower Working Group by W.R. Evans, Y. Akashi, N.S. Altman, and A.M. Manville.

- In comments to the FCC, the lead author of this study – William Evans – cites the Michigan study as definitive proof that steady-burning lights result in greater mortality at towers than flashing lights. Concerns about the Michigan study, due to sample size and potential biases in sample tower locations, are presented above.

- The Evans study indicates that flashing versus non-flashing light is much more important than the color of the light. The report also states, however, that red versus red strobe versus white strobe

[10] An Assessment of Factors Associated with Avian Mortality at Communication Towers – A Review of Scientific Literature and Incidental Observations, technical Comments Prepared in Response to the August 20, 2003 Notice of Inquiry Issued by the Federal Communications Commission (FCC) WT Docket No. 03-187, November 2003. Prepared by Woodlot Alternatives, Inc.

[11] Response of Night-migrating Birds in Cloud to Colored and Flashing Light, A report to the Communications Tower Working Group, January 2007. W.R. Evans, Y. Akashi, N.S. Altman, and A.M. Manville.

are all no different than darkness as an attractant to night-migrating birds. This was a finding that was not expected, and one that will require additional research to determine why it occurred. It contradicts comments made by others regarding red steady burning lights, and is an example that there is more to be learned about the effects of lighting as an attractant to night migrants before definitive design guidelines are implemented. We agree with the authors that more study is needed before policy decisions can be made regarding light color or light flashing frequency.

- The Evans study shares two of the same shortcomings found in the Michigan study and LPP report – the sample size is too low and the raw data were not made available. Thus, like those studies, the conclusions of the Evans study need to be independently confirmed before they can be fully credited. Accordingly, we concur with the author that the results of this study suggest further avenues of necessary research before definitive conclusions about lighting can be articulated.

- Study results are generally presented in graphic form and almost none are supported by a statistical analysis. We believe that the data are amenable to some form of statistical analysis and that such analyses should be conducted prior to relying on the conclusions drawn from the study to shape national policy.

- We agree with the authors that there is only a gross correlation between calling rates and actual numbers of birds in an area. It is possible, for example, that in some locations birds merely call more when faced with lights. We also agree with the authors that quantitative changes in bird density in response to changes in lighting parameters should be subjected to further study before broad policy decisions are made.

- Mean calling rate data shown in Figures 4 and 5 should be supplemented with error bars so that differences in calling rates can be objectively compared. This is especially important given that the authors did not subject their data to objective statistical analysis.

6.0 Conclusion

The Michigan and the Evans studies provide additional data regarding how birds interact with telecommunication towers. They add to the body of knowledge regarding tower characteristics and avian mortality. Little new information is provided in the USFWS report. The LPP comments are highly uncertain because of numerous assumptions and the inability to reproduce their regression analysis, which was the fundamental underpinning of their opinions. Overall, the state of the science is still insufficient to merit action because there are too few peer-reviewed studies, and study findings are not in agreement. One commonality is the recommendation that research continue.